Integration Engine

International Space Station's Web pages make ties that bind development effort

[Editor's note: This is the final installment in a three-part series about how JSC and its organizations are taking advantage of the Internet as a tool for public outreach and internal program management.]

By Bridget Mintz Testa

Many people and organizations think of the new information-sharing technology embodied by the World Wide Web solely as a vehicle for marketing their products and services, and by and large that's the approach most of NASA has taken.

The International Space Station Program is focusing its use of the Web as a tool for managing the program and building a vehicle—perhaps the most complex one ever conceived. As the information integration engine of the program, the station Web is a vital aid in storing, sharing and tracking everything from design specifications to assembly sequences, according to Deputy Program Manager William Shepherd.

"The Web is marketing, glitz, but it has not been used in the mainstream of development to tie people together," Shepherd says. "That's what we're trying to do. We're using it for schedules, agendas, minutes of meetings, locations of key managers and as a reference for all major flight elements and subsystems of the station. The Web page is the 'front-end' for large repositories of data that people need access to."

As such, the station Web concept enforces the use of consistent data across the far-flung program. The power of this method is in its ability to gather information produced by hundreds of people in their day-to-day work in a common storehouse with very little added effort and virtually no additional cost. The owners of each segment of data stored on the station Web pages (http://issa-www.jsc.nasa.gov/ss/SpaceStation_homepage.html) are required to keep that information accurate and up-to-date so that others in the program can rely upon it in doing their jobs.

This unusual, if not unique, use of the Station Web was at first unforeseen. Phil Padgett of Lockheed Martin recalls meeting in December 1993 with Shepherd and Paul Bolden (then NASA's technical monitor for Space Station Information Systems) to discuss a Department of Defense tool for getting information online. The Internet technology was still very new. "We didn't know much about it at that time," Padgett says. "I got an action to develop an understanding of it and prepare a demo for program management in January."

Padgett's demo of the Web software was a success. "Shep loved it," he said. "Then I was given a mission to establish a space station presence on the Web, organize data, set up policies and procedures, content and distribution of information via this new medium."

Shepherd

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>
> —William Shepherd
> International Space Station
> Deputy Program Manager

One of the benefits of this work was the realization that the station Web could be more than a public relations vehicle. Shepherd says, "Browser technology lets you have virtual connections to distributed databases. When we looked at all the things we do, involving engineering and management, we had two choices. We could create a self-contained hierarchical database or we could go to a distributed database. We've developed our Web browser to be the engine of a very large integration task."

The Space Station Web went online in March 1994, using the JSC Web page server—"Krakatoa"—as its host. It stayed there until October 1994, when it had to move to a larger machine dedicated to space station due to the massive traffic. "(Krakatoa) was overloaded, " Padgett says. "There were so many attempts to connect that people couldn't even get through."

The current ISS Web server is not likely to meet the same fate because it is four times as large and has about 10 times the storage space as the original server. Bert Beals, System Architect for Space Station Information Systems, says, "One of the reasons we went with this technology was that it was massively expandable and still inexpensive." The vast quantities of information the server contains, as well as its function as a critical tracking tool, make its high speed and large capacity necessary.

The first all-text ISS Web page included a station personnel phone book and a program overview. Today's pages include text and graphics for all major aspects of the program and links to five international pages at other Web sites. The information is broken into areas that contain completed information products that are available to the public, and a development area that contains work in progress being used by NASA and its partners as a tool for achieving program goals.

The publicly accessible section, called "Program Overview," includes station white papers, movies, pictures and other materials. Its companion, the "Technical Data Book" features detailed information on each station component and its place in the assembly sequence.

The development area, labeled "Program Team," includes information produced by and for Integrated Product Teams, Analysis and Integration Teams and Incremental Design Reviews, as well as the Program Control Book, all of which are critical parts of the management strategy for designing, building and maintaining the International Space Station.

The Program Control Book summarizes the International Space Station Program by creating a computerized counterpart to the Management Information Room in Bldg. 4S. The page is used by everyone from managers to engineers to budget analysts, and has a side benefit of allowing Congress to explore the program, Shepherd says.

"The concept is that if a Congressman visits, he/she can visit the MIC Room and get an overview of the program," says Roger Johnson, who is responsible for maintaining the MIC and the PCB, both of which use graphics extensively. "You can't glean anything from walls of text," Johnson explains. "You'd have to be a hard-core engineer to get anything out of it. That automatically leads to the PCB because it's the graphic display in electronic form."

To help the contributors who "feed" this distributed database, a "Policies and Procedures" section describes NASA, JSC and station online publishing guidelines, as well as Station Automated Information System policies.

There also are links to pages created by each of the international partners-the Italian Space Agency, Canadian Space Agency, European Space Agency, NASDA and Russian Space Science Institute-that describe their organizations, projects, plans, histories and archives.

Dan Duncavage, of the Phase 1 Program Office developing interfaces with the Russian space program, considers his Phase 1 page a resource. Also located in the Program Team section, this area describes Phase 1 activities, schedules, the program office and history. It also includes the shuttle-Mir icon and Mir images. "Making use of Phase 1 is crucial," Duncavage says. "The station is developing many plans for working with the Russians. We've never done that before. The Russians are very different from us. They think differently, do things differently." He feels the page also is a means to help station engineers transition from Phase I to Phase II.

A diverse group developed the original content. Ed Stanton, an engineer in the program office, was assigned to coordinate the initial population of the Program Overview and Technical Data Book sections. He developed a hyperlinked matrix that cross-references flight segments and engineering disciplines. The intersecting cells are links to the specific data for each flight. A click on each cell takes visitors to pages of introductory text, configuration information, a mission summary and each of the station's 13 major subsystems. Clicks on the assembly thumbnail images produce larger, downloadable versions. Stanton created the matrix using image-mapping—a process by which an area in an image is given specific coordinates. When such an area is clicked, the coordinates are read by the World Wide Web hypertext markup language and interpreted as a link to another page location.

However, Stanton didn't collect the data for the matrix pages himself. "By May of 1994," he says, "we had worked with the Astronaut Office to get five Navy ensigns (a sixth was here for two weeks). They did all the legwork and all the data entry. I could not have done that by myself. They had one specific task to do and they really went out and shook the bushes and trees." The ensigns left as permanent assignments with the Navy came in, taking with them not only thanks, but a JSC commendation as well.

The Space Station Web's technical monitor is Stephen Hunter, a data systems engineer with the Program Office and Information Analysis and Integration Team. Hunter views the Web as part of the program office's long-range planning for data communications. He says, "We knew we wanted to show what station looks like: history, differences from Freedom, a mix of literature about the program and technical data in support of the literature."

Apparently, it's working: the Web page sustained an average of about 140,000 hits per month from around the globe over the past 13 months.

Next on the agenda is expanding the page's scope to include virtual meeting rooms, virtual classrooms for the public, and a make-over to satisfy the novelty-hungry Web crowd. The Web also will be used to manage Integrated Design Review 2, showcasing its capabilities as an integration tool. Shepherd says, "The key point is that instead of a closed, firewalled database, the Web browser is a shell over many different data locations. The group's data is part of the database. We don't have a special group to manage the database: the groups do it themselves. For integrating a large, dispersed program it's a very powerful concept. If you took it all away, it would be a significantly lesser program." ❑

Top: The International Space Station Web provides information for the public, but its primary purpose is to integrate the information being used by the program to design and build an orbiting outpost. Above: The Technical Data Book includes a matrix of the baselined assembly sequence. Visitors may choose to look at more details on any topic simply by clicking on a gray or white square in one of the tables.